

men was in white granular cakes, and the second contained in addition masses of white silky crystals. On analysing the soluble portion of each it was proved that the mineral was *Alunogen* or "Hair Salt," with a composition of: Alumina 15.3, sulphuric acid 36 and water 48.7 per cent. This composition agrees with the formula of *Alunogen*, viz., $\text{Al}_2\text{O}_3 \cdot 3 \text{SO}_3 \cdot 18 \text{H}_2\text{O}$.

Himalayan summer storms and their influence on monsoon rainfall in Northern India.—By C. LITTLE, M.A.

In a paper which I read at the April meeting of this Society I pointed out that the monsoon season of 1902 could be divided into four periods, in each of which the character of the season as regards the distribution of rainfall and the movement of cyclonic storms which entered India from the Bay of Bengal were noticeably different. I gave a number of tabular statements showing that important changes appeared in the Himalayan region about the 30th of June and the 11th of August, that these changes did not begin over India, and that there was abundant reason for the belief that they approached India from Central Asia, that is, from an easterly or north-easterly direction. I gave the paper the title of "Two remarkable rainbursts in Bengal," because the unexpected occurrence of heavy rainfall in north-eastern India attracted my attention and led to the subsequent investigation.

Although the present monsoon season is not yet half over, there have, in my opinion, been already no fewer than three occasions on which the weather in Northern India has been influenced by similar disturbances, that is, by disturbances which have made their first appearance in the region of the Himalayas. I have called them Himalayan storms because they come within our range of observation when they reach the hills; but the probability is that they are due to depressions moving across Central Asia. Their appearance begins with an irregular fall of the barometer at stations in Northern India, and an indraught of winds in that direction: after a longer or shorter period pressure begins to rise, and this rise of pressure is accompanied by the commencement of rainfall, not I believe rainfall of the monsoon type, but the irregularly distributed, and often heavy rainfall caused by numerous thunderstorms.

The two storms of 1902 regarding which I gave details in the paper read on April 1st were rapid in their advance and widespread, so that within a few days their influence was felt along almost the whole length of the Himalayas.

The storms of the present season have been slower in their movement and of limited extent, so that their influence has been confined to sections of Northern India, the latest occurring only a few days ago when the unexpected rainburst in the United Provinces produced so important a change on the agricultural outlook in that region.

It is not my intention to give details of all these three disturbances, but the middle one of the three is so important, in my opinion, inasmuch as it confirms a conclusion I came to last year after the disturbance of August 11th. That conclusion was that these Himalayan disturbances not only have an influence on the motion of cyclonic storms which cross Northern India from the Bay of Bengal, but they directly contribute to their commencement. The Himalayan storm which entered north-east India on July 8th or 9th, 1903, is in its main features so similar to the storm of June 30th, 1902, and it resembled the storm of August 11th, 1902, in that it was followed by a remarkable series of cyclonic storms over the north of the Bay. Because of these similarities I think it desirable to give tabular statements for it, similar for purposes of comparison with the tables I gave in my previous paper. It will be seen from these tables that pressure began to fall on the 7th in the extreme north-east of Assam, that this fall was general along the Himalayan range on the 8th and 9th and was followed by a rise on the 10th. As these changes extended south-westward over Bengal, rainfall with a rapid fall of temperature became more general—between the 9th and 10th in North and East Bengal and between the 10th and 11th in the western districts. The small charts which are given in the Indian Daily Weather Report, one for the “variation of 8 A.M. pressure of day from normal,” and the other “variation of mean temperature of day from normal,” show more clearly than the tables the succession of changes which passed over Northern India with that Himalayan storm. The dates for which reference to these charts is suggested are from July 7th to 14th. An examination of the pressure charts will show that pressure was normal along the Himalayas on the 7th and practically over the whole of India. Two days later it was low over Northern India, but still practically normal over the continent. This low pressure area was displaced southward, and by the 13th we have pressure again normal over Northern India and low over the continent; while one depression has formed over the north of the Bay and another in the north-east of the Arabian Sea.

TABLE I.

Giving the pressure change daily from July 7th to July 13th, 1903, arranged to show the southward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+·010"	-·026"	-·055"	+·068"	+·001"	-·071"	-·014"
North Bengal ...	+·014	-·027	-·082	+·062	+·015	-·043	-·046
East Bengal ...	+·020	-·004	-·066	+·041	-·050	-·045	-·025
S.-W. Bengal ...	+·006	-·006	-·058	+·012	+·006	-·060	-·054
Orissa ...	+·007	+·015	-·044	-·029	-·018	-·075	-·129
Circars ...	-·005	+·020	-·027	-·021	-·020	-·054	-·078
Akyab ...	+·020	+·018	-·034	-·022	-·072	-·071	+·019
Diamond Island...	+·034	+·002	-·021	-·050	-·028	-·062	+·024

TABLE II.

Giving the pressure variation from the normal from July 7th to July 13th, 1903, arranged to show the southward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+·014"	-·011"	-·080"	-·014"	-·014"	-·076"	-·100"
North Bengal ...	+·025	+·008	-·078	-·019	+·001	-·042	-·084
East Bengal ...	+·037	+·034	-·031	+·011	-·038	-·082	-·107
S.-W. Bengal ...	+·029	+·026	-·032	-·019	-·012	-·070	-·123
Orissa ...	+·043	+·059	+·016	-·011	-·029	-·102	-·230
Circars ...	+·007	+·027	0	-·019	-·039	-·093	-·171
Akyab ...	+·024	+·043	+·009	-·012	-·083	-·153	-·133
Diamond Island...	+·055	+·007	-·014	-·064	-·091	-·153	-·129

The above tables show the southward movement of these changes in Eastern India, the commencement of the fall of pressure in Assam and North Bengal on the 8th, the general fall on the 9th followed by a

rise in Assam and Bengal Proper on the 10th, also the developing depression over the north of the Bay on the 12th and 13th.

TABLE III.

Giving the temperature change daily from July 7th to July 13th, 1903, arranged to show the southward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+0.6°	+1.4°	-1.0°	-3.5°	-0.2°	+3.1°	+3.2°
North Bengal ...	+0.4	-1.0	-1.8	-0.5	-3.9	-0.6	+2.8
East Bengal ...	+1.3	+0.7	-0.4	-1.9	-0.4	+2.8	-0.7
S.-W. Bengal ...	+0.2	+0.5	+0.8	+0.1	-2.9	-1.2	-0.2
Orissa ...	+2.0	+0.1	+0.4	+0.5	-2.0	-2.2	+0.4
Circars ...	+2.7	+2.5	-2.1	+3.4	+0.9	-4.4	-5.1
Akyab ...	+2.0	-2.2	+1.7	-0.5	+1.8	+0.7	-0.7
Diamond Island...	-1.3	+2.3	-1.0	+1.0	-2.8	+0.3	-0.8

TABLE IV.

Giving the temperature variation from the normal from July 7th to July 13th, 1903, arranged to show the southward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+1.8°	+0.9°	+1.0°	-0.6°	-3.2°	-0.9°	+1.8°
North Bengal ...	+2.6	+1.2	-0.6	-1.1	-5.2	-1.2	+1.7
East Bengal ...	+1.7	+2.1	+2.1	-0.3	-0.8	+7.3	+7.0
S.-W. Bengal ...	+2.5	+3.0	+3.7	+3.8	+1.0	+2.2	+2.1
Orissa ...	+3.2	+3.4	+4.2	+4.8	+3.2	+2.1	+3.0
Circars ...	+2.5	+0.1	-1.8	+1.8	+2.7	-1.5	-6.5
Akyab ...	+1.2	-0.9	+0.8	+0.3	+2.1	+2.8	+2.1
Diamond Island...	+0.7	+3.1	+2.2	+3.2	+0.4	+0.7	0

The temperature fall began in North Bengal on the 8th, it was general though not rapid on the 9th and 10th in Assam and North

and East Bengal, and extended to the south-western districts between the 10th and 11th. Defect was greatest in North Bengal on the 11th. In South-West Bengal and Orissa there was excess throughout, smallest in the former on the 11th and in the latter on the 12th. The large defect in the Circars on the 13th was probably due to the disturbed weather which accompanied the formation of the depression off Orissa and the Circars.

TABLE V.

Giving the pressure change daily from July 7th to July 13th, 1903, arranged to show the westward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+ '010"	- '026"	- '055"	+ '068"	+ '001"	- '071'	- '014"
North Bengal ...	+ '014	- '027	- '082	+ '062	+ '015	- '043	- '046
Bihar ...	+ '004	- '014	- '092	+ '064	+ '048	- '066	- '016
United Provinces	+ '024	- '039	- '113	+ '034	+ '023	+ '022	+ '001
Punjab ...	- '004	- '050	- '145	+ '030	+ '014	- '010	+ '126
Srinagar ...	+ '035	?	- '101	- '019	+ '008	0	+ '004

TABLE VI.

Giving the pressure variation from the normal from July 7th to July 13th, 1903, arranged to show the westward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+ '014"	- '011"	- '080"	- '014"	- '014"	- '076"	- '100"
North Bengal ...	+ '025	+ '008	- '078	- '019	+ '001	- '042	- '084
Bihar ...	+ '005	- '007	- '096	- '033	+ '013	- '052	- '065
United Provinces	+ '013	- '022	- '130	- '096	- '078	- '062	- '062
Punjab ...	+ '029	- '017	- '118	- '123	- '112	- '126	- '027
Srinagar ...	+ '111	?	- '039	- '016	- '013	+ '080	+ '104
Leh ...	+ '078	?	?	?	+ '031	- '018	- '023

The above tables show that the fall of pressure was general along the Himalayan range on the 8th and that it continued more rapidly on

the 9th, that the rise was equally general on the 10th but that it proceeded more slowly in the north-west than in the north-east. It appears to have been owing to the slow recovery of pressure in North-West India and the consequent retarding of the northerly wind in the upper atmosphere, that the depression in the Arabian Sea appeared two days later than the one at the head of the Bay. The recovery in the Punjab is shown on the 13th and the delay appears to have been due to the formation of a slight depression over that area in much the same way as occurs with cold season storms.

TABLE VII.

Giving the temperature change daily from July 7th to July 13th, 1903, arranged to show the westward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+0.6°	+1.4°	-1.0°	-3.5°	-0.2°	+3.1°	+3.2°
North Bengal ...	+0.4	-1.0	-1.8	-0.5	-3.9	-0.6	+2.8
Bihar ...	+0.6	+0.4	+1.1	+0.9	-5.2	-2.5	+0.1
United Provinces	-3.1	+1.6	+2.3	+1.3	-3.7	-3.6	-7.3
Punjab ...	-1.1	-6.1	+2.8	+3.8	0	-6.1	-8.8
Srinagar ...	-1.6	?	+2.6	+1.3	+1.2	-2.5	-5.4

TABLE VIII.

Giving the temperature variation from the normal from July 7th to July 13th, 1903, arranged to show the westward movement of the disturbance.

	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	+ 1.8°	+0.9°	+ 1.0°	- 0.6°	- 3.2°	- 0.7°	+ 1.8°
North Bengal ...	+ 2.6	+1.2	- 0.6	- 1.1	- 5.2	- 1.2	+ 1.7
Bihar ...	+ 4.8	+6.4	+ 7.2	+ 8.0	+ 2.7	+ 0.1	- 0.3
United Provinces	+ 8.3	+9.9	+12.1	+13.6	+10.0	+ 6.2	- 1.1
Punjab ...	+ 5.3	+8.2	+12.1	+15.1	+15.2	+12.4	+ 2.8
Srinagar ...	- 5.7	?	- 0.6	+ 0.9	+ 3.4	- 0.9	-10.2
Leh ...	-12.2	?	?	?	- 5.4	- 4.0	- 3.9

These tables show very clearly the westward movement of the second stage of the disturbance, that is, of the stage where with the rising pressure the northerly or north-easterly winds commence in the upper atmosphere accompanied by general thunderstorms, rainfall, and low temperature. The greatest change in Assam is on the 10th, in North Bengal and Bihar on the 11th, and in the United Provinces between the 11th and 13th. In the United Provinces the mean difference from normal temperature changed from excess of 14° on the 10th to defect of 1° on the 13th, and in the Punjab from excess of 15° on the 11th to excess of 3° on the 13th. At Srinagar the fall was from excess of 3° on the 11th to defect of 10° on the 13th.

TABLE IX.

Rainfall (July 7th to 13th, 1903).

	No. of Stations.	July 7th	July 8th	July 9th	July 10th	July 11th	July 12th	July 13th
Assam ...	5	1·31	1·67	2·81	7·59	3·19	2·86	1·17
North Bengal ...	7	3·28	2·86	7·57	13·72	12·52	5·68	0·41
East Bengal ...	7	4·54	1·81	2·78	7·94	1·87	1·53	3·01
S.W. Bengal ...	9	0·10	2·78	0·74	0·96	10·48	<i>Nil.</i>	1·76
Bihar ...	13	0·14	0·79	0·42	1·18	6·92	3·00	5·45
United Provinces	12	0·23	0·15	<i>Nil.</i>	0·10	1·36	3·02	4·36
Punjab ...	6	0·05	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	0·09	0·55
Simla Hills ...	5	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	0·36	5·23
Kashmir ...	6	0·09	?	?	<i>Nil.</i>	0·03	2·09	1·49
Darjeeling	1·29	0·66	0·32	0·42	0·80	0·02	<i>Nil.</i>
Cherrapoonjee	3·03	11·36	24·20	21·33	0·06	<i>Nil.</i>	<i>Nil.</i>
Orissa ...	4	0·02	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	1·68	1·85	2·21
Circars ..	4	<i>Nil.</i>	3·25	1·74	<i>Nil.</i>	0·38	5·21	5·61

The rainfall in the above table has been prepared as in the previous paper referred to above. The figures give the total fall in each division or Province, and the number of stations is given in the first column. The average fall may be obtained by division. It may be seen that rainfall was increasing in Assam and North Bengal from about the 7th, that it was most heavy in those parts on the 9th and 10th, and that

the increase in the west and south-west of Bengal is shown on the 11th. No rain fell on the Simla Hills until the 12th and the increase in Kashmir began on the same date.

As in the storms in 1902, strong southerly or south-westerly winds developed at Saugor Island, and generally over Northern India, showing a strong indraught towards a low pressure area in the north. The contention that no disturbance had formed over India or the adjacent seas previous to these changes in the Himalayan region is supported by the following quotation from the Indian Daily Weather Report of date July 9th, 1903. "An important change has taken place in the distribution of pressure and very steep gradients favouring strong south-westerly or westerly winds prevail over the greater part of Northern India. These winds are, however, up to the present, dry winds and are not an extension of monsoon winds from the Arabian Sea: hence no rain of any importance may be expected during the next 24 hours in North-West India, though local dust storms may occur in that area."

In the following table I have given the wind direction and strength at Saugor Island for the two periods of disturbed weather in 1902 and for the one under discussion, placed side by side for purpose of comparison. During the advance of these disturbances from the north there was almost the same wind direction and strength at Saugor Island on the three occasions. The direction was south-south-west almost continuously and there was a steady increase of velocity.

1902	Daily velocity in miles.		Wind direction at 8 A.M.	1902.		Daily velocity in miles.	Wind direction at 8 A.M.	1903.		Daily velocity in miles.	Wind direction at 8 A.M.
June	27	312	S.S.W.	August	8	360	S.W.	July	7	432	S.
	28	408	S.S.W.		9	504	S.S.W.		8	552	S.S.W.
	29	576	S.S.W.		10	768	S.		9	696	S.S.W.
	30	840	S.S.W.		11	394	W.S.W.		10	624	S.S.W.
July	1	360	W.S.W.	12	288	S.W.	11	408	S.S.E.		
	2	456	S.W.	13	384	W.S.W.	12	168	E.		
	3	384	S.W.	14	120	W.N.W.	13	216	E.N.E.		

A point of interest which may be noticed in the table is in the wind changes during the days 12th to 14th August, 1902, and 11th to 13th

July, 1903. In the former case the wind turned to northerly through west and in the latter through east. The reason appears to be that the cyclonic storm which developed subsequently over the north of the Bay last year was a little more eastward than this year.

In the previous paper I gave some facts showing the passage of the disturbance on June 30th, 1902, over Bengal, and more detailed information for Calcutta partly from personal observation. On that occasion the disturbance began to affect weather at Calcutta about 5 A.M., and its progress was shown by the continued fall of temperature. The disturbance this year began about 5 P.M. and came on as last year with a rush of wind from the north accompanied by light rainfall, some thunder and a rapid fall of temperature. The fall of temperature was more rapid than last year, and was in the course of an hour from 92° at 5 P.M. to 78° at 6 P.M. This greater rapidity was partly due to the disturbance occurring at the end instead of the beginning of the day.

The barometer at Calcutta was only slightly affected and in much the same way as last year. The small irregularities began about 1 P.M. and a slightly more rapid rise than usual began about 5 P.M., followed by a fall which was completed about 7 P.M.

I have mentioned that since the commencement of the monsoon season there have been several of these disturbances. There were, I believe, between June 13th and July 23rd, no fewer than four, although, with the exception of the one for which tables have been given above, they were not of so well marked a character as to make them useful for establishing the occurrence of such disturbances. They possessed, however, more or less distinctly the characters of the storms which have been more fully described. These characters are—

- (1) A fall of pressure along the Himalayan range, followed by a rise, both the fall and the subsequent rise being apparently unconnected with the pressure changes in progress on the plains of India, and having a southward progressive motion.
- (2) An indraught from the plains towards the hills shown by strongish south-westerly winds in Northern India.
- (3) Unsettled weather in the Himalayas and adjacent plains, with numerous thunderstorms and a rapid fall of temperature.

The last of these appears to be due to a strong northerly or north-easterly wind from Thibet, across the Himalayas into the upper atmosphere of the Indian plains.

It is not my intention to prove the existence of the smaller disturbances. It will be sufficient for my purpose if I mention approximately the dates of their occurrence, and these dates can be readily found from

the rainfall at Cherrapoonjee. Owing, probably, to the indraught which these Central Asian storms cause up the Brahmaputra valley, there has been in all cases which I have examined, an increase, at times a very great increase of rainfall at Cherrapoonjee. I do not wish it to be understood that in the occurrence of such heavy rainfall there is proof of a disturbance in Central Asia, but when the rainfall cannot be accounted for by any changes proceeding over India, and the other characters of Himalayan storms can be traced, the rainfall affords a valuable item of evidence. I give in a table below the rainfall for June and July, from which it can be easily seen that there were, during that period, six occasions of increased rainfall, the most noticeable being the falls of 24 and 21 inches on the 9th and 10th July, with the storm I have described above. The other dates approximately were June 10th, June 16th, June 22nd, June 29th, and July 20th.

Rainfall at Cherrapoonjee.

	June.	Inches.		June.	Inches.		July.	Inches.		July.	Inches.
	1	2		17	10		1	2		17	0
	2	0		18	6		2	1		18	0
	3	0		19	2		3	4		19	2
	4	1		20	2		4	3		20	4
	5	0		21	3		5	2		21	2
	6	0		22	8		6	1		22	2
	7	0		23	1		7	3		23	0
	8	0		24	0		8	11		24	3
	9	7		25	0		9	24		25	2
	10	4		26	1		10	21		26	0
	11	5		27	8		11	0		27	1
	12	0		28	8		12	0		28	0
	13	3		29	19		13	0		29	1
	14	5		30	0		14	1		30	3
	15	8					15	0		31	0
	16	7					16	0			

The occasions on which pressure fell along the Himalayan range were June 9th, June 17th, July 8th, July 18th.

The disturbances which passed along the Himalayas about the 9th and 17th June appear to have commenced in the north-west and advanced eastward, and they were probably followed by a north-westerly wind in the upper atmosphere. My reason for thinking that the upper wind was north-westerly during the latter part of June is based on the direction in which thunderstorms moved over Bengal during that period. In a paper read by me at the last meeting of the Society I stated that thunderstorms during the past hot season had been abnormal in several respects, the most noticeable being that instead of approaching from the usual north-westerly direction they had without exception come from the west. After the middle of June, thunderstorms continued but they no longer moved from the west. Instead they had become, so far as direction went, typical nor'westers.

A storm of a very exceptional kind began over Orissa in the early morning of the 11th June. It was of the thunderstorm type and moved southward along the coast, causing squally weather in the north of the Circars on the forenoon of that date and in the south in the afternoon. I mention it in this connection as showing the existence of a northerly wind in the upper atmosphere in that region.

After a period of continuous low pressure over Northern India from the 17th to the 22nd June, a general rise began along the hills and extended southward. This rise was probably accompanied by an increase of velocity in the upper northerly wind, as a depression which was beginning to form over the Bay, developed over the north-west angle, moved into Chota Nagpur, and then recurved into Bihar and north Bengal. The heavy rainfall at Cherrapoonjee between the 27th and 29th June was caused by this storm, and the recurving was probably due to the north-westerly wind aloft.

The next occasion of disturbed weather in the Himalayan region was between the 7th and 13th July, and that has been already discussed. The last disturbance began about the 17th July and was very little felt at the eastern end of the Himalayan range. The only indication is the falling pressure in Assam on the 17th and the indraught up the Brahmaputra valley. But in the centre and west of the range there were important developments. Thunderstorms with heavy rainfall and large changes of pressure occurred. This rainfall is very similar to the rainbursts which occurred in Bengal last year, and it is difficult to account for its occurrence by any series of changes then in progress in India. A cyclonic storm was shown in the Indian Daily Weather Report of the 18th, but, as stated under the heading of pressure in that report

the depression moved westward. The slight to moderate deficiency of pressure in the United Provinces was not, as was quite natural under the circumstances, recognised as the commencement of the disturbance which was to cause the first heavy rain of the season in the United Provinces, or, as the disturbance developed, the floods in Kashmir. I note these matters to show how unsuspected the rainfall was, and that forms the strongest argument, in my opinion, in favour of the disturbance not being connected directly with the weather changes in progress at that time over India.

There only remains to point out a few of the more important features of the weather of the past few months as regards storms in the Bay of Bengal and monsoon conditions in Northern India. Throughout the hot season the northerly element in the upper wind was conspicuously absent in Lower Bengal, and whether or not by reason of that abnormal wind direction, not a single depression formed over the Bay up to the middle of June. Then a disturbance appeared over the Himalayas, weather became disturbed over Bengal, and when the final rise of pressure followed, a depression formed over the north-west of the Bay. That storm recurved to the north-east over the western districts of Bengal. Throughout June, rainfall was abundant in Bengal Proper and Assam, but not in the western districts.

The second stage began with the Himalayan storm of the 10th July. It may be remembered that in 1902 the Himalayan storm of August 11th was followed by a "remarkable series" of cyclonic storms which formed at intervals of a week. The first three of these moved westward and saved part of Western India from impending famine. The fourth moved northwards into Chota Nagpur and filled up there. Now this year, since the storm of July 10th, there has been an even more remarkable series of cyclonic storms. At regular intervals of five days four depressions of greater or less intensity have formed in the north-west angle. The dates of commencement of these depressions are July 12th, 17th, 22nd, and 27th. The first was the most severe, and although conditions appeared to be exceptionally favourable for its advance towards Western India it broke up and disappeared about the 15th. The second depression disappeared over Chota Nagpur and the adjacent part of Central India. The third which began in the north-west angle of the Bay on the 22nd moved rapidly westward, was a well-defined depression over the Central Provinces on the 24th, in the Central Indian Plateau on the 25th, and in the north-west dry area on the 26th.

The behaviour, therefore, of the third depression, was quite different from that of the second which filled up in the Chota Nagpur region. The cause of this change was probably the Himalayan storm of the 19th

which was probably followed by a stronger north-easterly wind overhead. This upper north-easterly wind probably extended southwards over North-Western India and was, I believe, an important factor in maintaining the vitality of the disturbance during its passage westward. The fourth depression has been doubtful. Part of it appears to have moved westward, and part northward into Bengal.

The rainfall distribution in Northern India has been well-defined, and as in 1902 there has been an evident connection with the Himalayan storms. During June and the first week of July, that is up to the occurrence of the more decided Himalayan storm of July 10th, rainfall was almost entirely confined to Bengal and Assam. After that disturbance passed over Bengal and cyclonic storms began at the head of the Bay the character of the rainfall changed in Bengal. Only light scattered showers fell. On the other hand, rainfall became more general in Central India, and, after the Himalayan storm which began in the western half of the range about the 19th, rainfall became general in the extreme west.

The behaviour of the last depression of the series shows that the change produced by these Himalayan storms in Bengal is coming to an end, and while I write cloud is increasing and ordinary monsoon weather is becoming general over this Province.

It should be noticed how the west of Bihar appears to have been very little affected by either of the more important of the Himalayan storms. The one of the 10th July was probably confined more, as regards after-effects, to Bengal, and that of the 19th July to the north-west. The result has been that the west of Bihar and the adjacent part of the United Provinces have, during the three months ending with July, received less rain than they usually receive during June alone.
